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PUBLICATIONS AND PATENTS  
of the  
NORTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION  
Peoria, Illinois, for the period  
JULY - DECEMBER 1958

Agricultural Research Service  
UNITED STATES DEPARTMENT OF AGRICULTURE

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The abstracts for these publications and patents describe current research activities and indicate progress achieved by the Northern Division. Congress in 1938 authorized four regional laboratories to conduct basic and applied research designed to expand, improve, and develop through science and technology the utilization of American farm crops. Agricultural products assigned the Northern Division for study are: Wheat, corn, and other cereal grains; soybeans, flaxseed, and other oilseeds; and new crops.

Previous lists of publications and patents were issued as NM-305, AIC-187, and AIC-318, with supplements. Copies of these lists are available on request.

July - December 1958

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## PUBLICATIONS

[Publications marked (\*) are not available for distribution.]

### MICROBIOLOGICAL PRODUCTION OF BETA-CAROTENE IN SHAKEN FLASKS.

Ralph F. Anderson, Margie Arnold, George E. N. Nelson, and Alex Ciegler.  
J. Agr. Food Chem. 6(7): 543-545. July 1958.

When appropriate plus and minus strains of various members of the Choanephoraceae were grown together in a grain-based medium in shaken flasks, carotene production was increased four- to fivefold over that obtained with unmated strains. Production of carotene by mated cultures was further enhanced by the addition to the medium of vegetable oils, detergent, and  $\beta$ -ionone. Chromatographic analysis showed that 75% of the pigments produced was all-*trans*- $\beta$ -carotene.

### CHANGES IN THE COMPOSITION OF SOYBEANS ON SPROUTING.

L. L. McKinney, F. B. Weakley, R. E. Campbell, and J. C. Cowan.  
J. Am. Oil Chemists' Soc. 35(7): 364-366. July 1958.

Soybeans were sprouted for 2, 3, 4, 5, and 6 days and changes in nitrogen and oil contents were determined. There was no appreciable change in nitrogen and oil contents, nor appreciable increase in free-fatty acids during these periods of germination.

### PRODUCTION OF CALCIUM 2-KETOGLUCONATE BY FERMENTATION WITH SPECIES OF *PSEUDOMONAS*.

V. F. Pfeifer, C. Vojnovich, E. N. Heger, G. E. N. Nelson, and W. C. Haynes.  
Ind. Eng. Chem. 50: 1009. July 1958.

This paper describes pilot-plant procedures used to produce and recover relatively large quantities of calcium 2-ketogluconate for field tests of its commercial use in foods.

Employing aseptic technique and suitable conditions of agitation, aeration, anti-foam, and temperature, yields of about 75 pounds of anhydrous calcium salt were obtained from 100 pounds of anhydrous glucose. Calcium salt was recovered by clarifying the fermented liquor, evaporating the clear liquor below 130° F., and crystallizing at 60° F. About 70% of the salt produced during fermentation was recovered in the first crystallization, and an additional 10% by a second concentration and crystallization.

Cost estimates indicate that calcium 2-ketogluconate containing 85% of the anhydrous salt may be produced by this process at a production cost of about 41 cents per pound.

### THE PROTEINS IN WATER EXTRACTS OF CORN.

E. M. Craine and K. E. Fahrenholtz.  
Cereal Chem. 35(4): 245-259. July 1958.

The proteins in water extracts of corn from insoluble precipitates while aging at low ionic strengths and when frozen and thawed. This instability prevents assay of protein fractions by solubility methods. The extracts are stabilized by addition of salt or by removal of anion contaminants.

Some of the extract proteins react with phytate ions at pHs below 5 to form insoluble complexes. Precipitation of these complexes aids the fractionation of the proteins. Increasing the ionic strength of the extract decreases the pH at which a particular protein-phytate complex precipitates.

Among six protein components identified electrophoretically three are major portions of the protein. Each can be prepared in fairly homogenous condition. One of these combines with a dialyzable anion to form a soluble complex which can be detected electrophoretically at pH 8.6. The protein composition of two different samples of corn varied as one of the major protein components could not be detected in one sample.

In purification of seed proteins removal of phytate ions is desirable. A method for their removal from protein using highly cross-linked anion exchange resin is described.

The extracts have enzymes capable of hydrolyzing the endogenous proteins. They have optimum activity at a pH of about 4 and are inactive at pH 7 or above at low temperatures.

#### REACTIONS OF UNSATURATED FATTY ALCOHOLS. V. PREPARATION AND PROPERTIES OF SOME COPOLYMERS OF UNSATURATED FATTY VINYL ETHERS WITH LOWER ALKYL VINYL ETHERS.

L. E. Gast, Wilma J. Schneider, J. L. O'Donnell, J. C. Cowan, and H. M. Teeter.  
J. Am. Oil Chemists' Soc. 35(7): 347-350, July 1958.

Copolymers of soybean vinyl ether and lower alkyl vinyl ethers were prepared at three molar compositions. Baked films of these copolymers were hard, wrinkle-free, resistant to most common solvents, and were 20 to 500 times more resistant to aqueous alkali than soybean vinyl ether polymer films prepared under the same conditions.

#### A TWO-COMPARTMENT HOLLOW PRISM,

Eugene H. Melvin and Duncan Macmillan.  
J. Opt. Soc. Am. 48(8): 581, August 1958.

A two-compartment hollow prism for the determination of refractive indices of solvent and solution is described. The measuring instrument employed was a spectrophotometer. Absolute values for refractive index can be obtained, or a differential method for measuring refractive index differences can be used.

#### REACTIONS OF CONJUGATED FATTY ACIDS. VII. CATALYTIC CYCLIZATION AND AROMATIZATION OF *CIS,TRANS*-OCTADECADIENOIC ACID WITH SELENIUM.

H. M. Teeter, E. W. Bell, and M. J. Danzig.  
J. Org. Chem. 23(8): 1156-1158, August 1958.

When heated at 250° C. with a selenium catalyst, *cis,trans*-conjugated methyl linoleate is converted to a mixture of monounsaturated esters (67%) and cyclized esters (31%). The cyclized material, which could be converted to *o*-phthalic acid in 54% yield, appears to be a mixture of substituted benzene and cyclohexene derivatives. In the presence of hydrogen acceptors such as crotonic acid or nitrobenzene, the proportion of cyclized esters in the product is increased. Kinetic measurements based on infrared data show that the *cis,trans* ester is isomerized to its *trans,trans* form and that it is the latter that cyclizes and disproportionates to give the observed products.



REACTIONS OF CONJUGATED FATTY ACIDS. VIII. DIBASIC ACIDS BY HYDROGENATION AND OXIDATIVE CLEAVAGE.

C. R. Schölfield, E. P. Jones, J. A. Stolp, and J. C. Cowan.  
J. Am. Chemists' Soc. 35(8): 405-409. August 1958.

Alkali conjugated linoleic acid may be hydrogenated as sodium soap in aqueous or ethylene glycol solution with commercial nickel catalysts. Under suitable conditions this acid is reduced predominantly to monounsaturated acids with only a slight increase in saturated acids. One set of suitable conditions is: Place 10 grams of conjugated linoleic acid, 7 grams of sodium hydroxide, 250 milliliters of water, and 0.05 grams of nickel under 40 lb./in. hydrogen pressure and heat at 140° C. for 1 hour. The acids from this reaction mixture had an iodine value of about 90. Oxidation and chromatographic analysis of resultant dibasic acids indicated the presence of over 60% with double bonds in the 10, 11, and 12 positions.

ANTIBIOTICS AGAINST PLANT DISEASE. III. DURAMYCIN, A NEW ANTIBIOTIC FROM *STREPTOMYCES CINNAMOMEUS* FORMA *AZACOLUTA*.

Odette L. Shotwell, Frank R. Stodola, William R. Michael, Lloyd A. Lindenfelser, Robert G. Dworschack, and Thomas G. Pridham.  
J. Am. Chem. Soc. 80: 3912-3915. August 1958.

Duramycin, a polypeptide antibiotic, has been obtained from culture filtrates of *Streptomyces cinnamomeus* forma *azacoluta*. This antibiotic is active against gram-positive rods and some yeasts and fungi. Initial studies indicate that the antibiotic contains at least nine amino acids, two of which contain sulfur. A crystalline picrate of duramycin has been prepared.

LYSINE, METHIONINE AND TRYPTOPHAN CONTENT OF MICROORGANISMS. I. BACTERIA.

Ralph F. Anderson, Robert A. Rhodes, George E. N. Nelson, Margaret C. Shekleton, Albert Barreto, Jr., and Margie Arnold.  
J. Bacteriol. 76(2): 131-135. August 1958.

Cells of a wide variety of bacteria were analyzed for their lysine, methionine, and tryptophan content. The bacteria studied contained from 2.6 to 13.5 (average 6.5) grams of lysine, 0.7 to 4.5 (average 1.8) grams of methionine, and 0.1 to 0.8 (average 0.3) gram of tryptophan per 16 grams of nitrogen. In general, the quantities of these amino acids contained in bacterial cells were characteristic of the individual strain of the organism and were not related to its classification. However, organisms of the order *Eubacteriales* contained more lysine than did organisms classified as *Actinomycetales*; among the *Eubacteriales* gram-positive bacteria contained more lysine than did gram-negative bacteria.

PRODUCTION OF EXTRACELLULAR INVERTASE BY THE YEAST, *SACCHAROMYCES UVARUM* NRRL Y-972.

Robert G. Dworschack and Lynferd J. Wickerham.  
Arch. Biochem. Biophys. 76(2): 449-456. August 1958.

It was previously believed that yeast invertase is exclusively an endoenzyme and was not secreted into the medium by the living cell. This paper describes the production of a soluble invertase by viable *Saccharomyces uvarum* NRRL Y-972 cells under aerobic or anerobic conditions. The ratio of extracellular to intracellular invertase is highest in the early phase of fermentation and decreases thereafter. Three times more invertase was produced by this strain when grown aerobically as when grown anerobically. Variations in culture conditions are discussed.

## EVIDENCE OF THE PRODUCTION OF EXTRACELLULAR INVERTASE BY CERTAIN STRAINS OF YEASTS.

Lynferd J. Wickerham.

Arch. Biochem. Biophys. 76(2): 439-448. August 1958.

Invertase, derived principally from yeast, is perhaps the most widely studied of all enzymes. It is universally believed that living yeasts do not secrete invertase. This manuscript reveals that this belief is erroneous. The present work may lead to a procedure for obtaining crystalline invertase for the first time.

## PILOT-PLANT PRODUCTION OF GROUND *SERRATIA MARCESCENS*.

V. F. Pfeifer, Charles Vojnovich, H. G. Maister, V. E. Sohns, E. N. Heger, and W. M. Bogart.

Ind. Eng. Chem. 50: 1143-1148. August 1958.

Investigations described in this paper were made in the development of a process for preparing relatively large amounts of fine powder containing high concentrations of *Serratia marcescens*.

Powdered concentrates of *S. marcescens* were produced in suitable combinations of fermentation, centrifugation, pelleting, freeze-drying, and grinding. The complete process incorporated pH control throughout fermentation, and the use of a continuous, controlled solids-discharge centrifuge, a continuous freeze-dryer, and a high-speed centrifugal grinding mill.

Powder produced by the process contained about 21% of the viable cells present in the fermented liquor, and had a viable cell count of about  $1400 \times 10^9$  per gram. The powder exhibited good storage stability, and was suitable for creating slow-settling aerosols.

## COOPERATIVE NEW CROPS RESEARCH--WHAT THE PROGRAM HAS TO INVOLVE.

Ivan A. Wolff and Quentin Jones.<sup>1</sup> <sup>1</sup>USDA Crops Research Division, Beltsville, Maryland, Chemurgic Dig. 17(9): 4-8. September 1958.

A sustained research program which includes well-planned screening followed by evaluation and development stages for appraisal of the merit of selected plant species is the logical approach in the search for potential New Crops. Botanists and chemists in the Agricultural Research Service are making a coordinated effort to inventory a large number of varieties of plant species to discover those of possible value. Initial efforts are directed toward screening for valuable sources of fiber for pulping, proteins, and industrial oils. Additional objectives will be included as the New Crops program progresses. Each stage of the various investigations from screening through practical development will be characterized by parallel, cooperative research in both Production and Utilization groups.

## CAROTENOID CONTENT OF THE GRAIN FROM YELLOW ENDOSPERM-TYPE SORGHUMS.

C. W. Blessin, C. H. VanEtten, and Richard Wiebe.

Cereal Chem. 35(5): 359-365. September 1958.

Methods for estimating total carotenes and total xanthophylls and for isolating and identifying the major carotenoids were adapted for use on grain sorghum. It was found that the grain of common varieties of sorghum contains about 1.5 p.p.m. of total carotenoids. Crosses obtained in preliminary plant breeding of common varieties with African yellow endosperm varieties were found to contain carotenoids as high as 8 to 9 p.p.m. Carotenoid content was higher when the seeds were protected from the weather after pollination. Major carotenoids present were identified as lutein, zeaxanthin, and  $\beta$ -carotene. Other carotenoids present in small amounts in both feed sorghum and yellow corn, which was used for comparison purposes, were described but not positively identified. Carotenoids found in yellow corn but not detected in the grain sorghum were cryptoxanthin, hydroxy- $\alpha$ -carotene, and  $\alpha$ -carotene.



#### A METHOD FOR DETERMINATION OF BRAN IN FLOUR.

W. L. Deatherage and Majel M. MacMasters.

Cereal Chem. 35(5): 380-391. September 1958.

A method has been developed for the direct determination of bran in flour. The other constituents of the flour are largely removed by solution or dispersion with alkali, followed by filtration. The bran particles remaining on the filter are transferred to a graduated tube, recovered in a centrifuge under controlled conditions, and the volume measured. The bran particles divide, on centrifuging, into two layers. The upper layer is white or colorless and the lower is brown. The weights of the two layers were determined separately. The volume of the particles recovered and their dry weight are nearly linearly related. Volume or weight of either total particles recovered or of brown particles is not clearly related to the ash content of the flour. There is some relationship between volume or weight of either total particles or of brown particles with the Kent-Jones and Martin Color Grader Value, but the relationship is not linear. Photomicrographs show that in reality most of the bran is white or colorless and that often it is only a relatively small portion of seed coat or pigment strand which causes a whole particle to appear brown.

#### NOTE ON A RAPID METHOD TO SCREEN CORN SAMPLES FOR APPROXIMATE AMYLOSE CONTENT IN THE STARCH.

R. R. Savage, W. L. Deatherage, Majel M. MacMasters, and F. R. Senti.

Cereal Chem. 35(5): 392-394. September 1958.

A new screening method is described which decreases the analytical work required to select inbred lines, genotypes, etc., for use in breeding corn with starch of high-amylose content. The endosperm is removed from the corn, ground to pass 40-mesh, and treated with warm alkali solution under definite, controlled conditions. The starch granules are then observed microscopically to determine if they have completely lost birefringence. The higher the amylose content, in most cases, the less readily the granules lose birefringence. Application of the method has allowed discard, without further analysis, of about 33% of some lots of corn received from plant breeders.

#### CERTAIN FACTORS AFFECTING THE INFRARED SPECTRA OF SELECTED MICROORGANISMS.

W. C. Haynes, E. H. Melvin, Joan M. Locke, C. A. Glass, and F. R. Senti.

Appl. Microbiol. 6(5): 298-304. September 1958.

Among some 4,000 infrared curves of 356 strains of bacteria which were grown on fortified tryptose agar, we found some which were distinguished by a distinct band at 5.7 microns and by subsidiary bands at 7.8 and 8.5 microns. The majority of these unique spectra belong to 25 strains in three species of the genus *Bacillus*. Further investigation revealed that the 5.7-type spectrum is not produced by these aerobic sporeformers, if grown in the absence of glucose, galactose, glycerol, fructose, or other satisfactory precursors. Two subtypes of the 5.7-type *B. megaterium* were recognized based on the effect of culture age upon the spectrum.

#### ESSENTIAL AMINO ACIDS IN MICROBIAL PROTEINS.

R. F. Anderson and R. W. Jackson.

Appl. Microbiol. 6(5): 369-373. September 1958.

In terms of present-day knowledge of nutrition it is evident that the quantity and quality of proteins in rations and diets need still to be improved. Deficiencies can be overcome by the use of chemically synthesized amino acids, but their cost does not permit unlimited use. Moreover, essential amino acids contained in digestible proteins are used more economically in the animal body than are amino acids which are ingested in the free state.

Inasmuch as many microorganisms are capable of synthesizing proteins abundantly from simple raw materials, the use of microbial proteins in feedstuffs is of considerable interest. As a consequence of nutritional interest as well as of scientific curiosity in unusual new proteins or protein mixtures, some explorations have been made into the amino acid make-up of the proteins which occur in the cells of microorganisms. The purpose of this review is to organize and present the results which have been published in this field during the last 10 years.

#### THE LABELLING OF FATTY ACIDS BY EXPOSURE TO TRITIUM GAS.

H. J. Dutton, E. P. Jones, L. H. Mason, and R. F. Nystrom.  
Chem. & Ind. (36): 1176-1177. September 1958.

The description by Wilzbach of a simple process for tritium-labeling of organic compounds suggested its application to fatty acids. It was found that substitution occurs in saturated fatty acids, but addition was the principal reaction in higher unsaturated acids. These results suggest the need for establishing the nature of the tritiation reaction in labeling olefinic compounds by the gas exposure technique.

#### PREPARATION OF 3-STEAROYL-D-GLUCOSE--A BREAD SOFTENING AGENT.

F. H. Otey and C. L. Mehlretter,  
J. Am. Oil Chemists' Soc. 35(9): 455-457. September 1958.

In previous work 3-stearoyl-D-glucose was found to have superior bread softening action. This paper describes its synthesis by reaction of stearoyl chloride with 1,2:5,6-diisopropylidene-D-glucose and subsequent deacetonation of the intermediate stearoyl diisopropylidene-D-glucose. Acetonation of the product, followed by saponification of the acyl group produced 1,2:5,6-diisopropylidene-D-glucose and indicated that the substance is 3-stearoyl-D-glucose.

#### VISCOSITY BEHAVIOR OF PERIODATE- AND HYPOCHLORITE-OXIDIZED STARCHES.

R. L. Mellies, C. L. Mehlretter, and I. A. Wolff,  
Ind. Eng. Chem. 50(9): 1311-1314. September 1958.

Preliminary studies of the viscosity properties of aqueous dispersions of periodate oxidized starches indicated that they compared favorably with commercially available hypochlorite oxidized starches. A more detailed investigation was thereby warranted.

In addition to quantitative viscosity determinations, using the Corn Industries viscometer, on a series of each of the two types of starches, the effect of addition of sodium chloride has been studied. Viscosities are less sharply reduced by addition of salt in the periodate than in the hypochlorite series. Deashing of the latter lowers their viscosities markedly. Higher temperatures and longer times of drying, and extended periods of storage are factors which decrease the viscosity of periodate oxidized starches.

Consideration of the data obtained will aid in suggesting industrial applications of periodate oxidized starches.

# SOIL-CONDITIONING PROPERTIES OF MODIFIED AGRICULTURAL RESIDUES AND RELATED MATERIALS. I. AGGREGATE STABILIZATION AS A FUNCTION OF TYPE AND EXTENT OF CHEMICAL MODIFICATION.

H. E. Smith, S. M. Schwartz, L. A. Gugliemelli, P. G. Freeman, and C. R. Russell.  
Soil Sci. Soc. Am. Proc. 22(5): 405-409. Sept.-Oct. 1958.

The feasibility of producing soil-conditioning agents from agricultural residues by chemical modification was investigated. Such reactions as xanthation, cyanoethylation, methylation, hydroxyethylation, sulfation, phosphorylation, acetylation, and oxidation were applied to wheat straw, corn stover, corncobs, bagasse, rice hulls, and their major components. From results of comparative reactions on cellulose, hemicellulose, and lignin, the major part of the soil-conditioning activity of chemically modified agricultural residues was found attributable to the substituted cellulose fraction. The extent of substitution required to produce active products varies with the nature of the derivative but coincides in all cases with that required to give water-soluble products. Within these limits the degree of polymerization has more influence on aggregate stabilizing activities than either the type or extent of substitution. Data on a number of microbial gums, plant polysaccharides, and starch derivatives are also presented.

# SOIL-CONDITIONING PROPERTIES OF MODIFIED AGRICULTURAL RESIDUES AND RELATED MATERIALS. II. PERSISTENCE OF SOIL-STABILIZING ACTIVITY AS A FUNCTION OF TYPE AND EXTENT OF MODIFICATION.

S. M. Schwartz, P. G. Freeman, and C. R. Russell.  
Soil Sci. Soc. Am. Proc. 22(5): 409-414. Sept.-Oct. 1958.

Agricultural residues, cotton linters, several of their chemical derivatives, and other related products incorporated in Miami silt loam were tested for their in-soil stability against microbial degradation in a controlled humidity cabinet for a period of 6 months.

Forty- to sixty-mesh wheat straw, incorporated at a concentration of 0.5%, imparted greater stability to soil aggregates than did comparable applications of soybean and cotton stalks and corn stover, after the first month of incubation at a temperature of 28° C. Twenty- to sixty-mesh cotton linters at 0.5% concentration yielded increasingly effective soil aggregation during the first 3 months of incubation, reaching a maximum aggregation value of 93%. Carboxymethyl cellulose with a degree of substitution of 1.2 retained approximately 70% of its initial soil-stabilizing activity over a 6-month test period. In the case of hydroxyethyl and methyl cellulose, data are presented which tend to show that a high degree of substitution is not an adequate criterion of resistance to microbial degradation. Rather, the susceptibility of such polymers to enzymatic hydrolysis is apparently attributable to a lack of uniformity of substitution, resulting in a relative abundance of unsubstituted units in the cellulose chain.

# CORN AMYLOSE AND AMYLOSE TRIACETATE FIBERS.

Ivan A. Wolff.  
Ind. Eng. Chem. 50(10): 1552. October 1958.

Fibers have been prepared from amylose triacetate by dry-spinning from chloroform solution. These fibers, generally similar to acetate rayon, can be oriented by drawing to increase their breaking strength. Alkaline deacetylation of the triacetate fibers provides free amylose fibers. These are white and lustrous, but weaker than the parent ester fiber.



## DEVELOPMENT OF AMYLOMAIZE--CORN HYBRIDS WITH HIGH AMYLOSE STARCH. I. GENETIC CONSIDERATIONS.

M. L. Vineyard,<sup>1</sup> R. P. Bear,<sup>1</sup> M. M. MacMasters, and W. L. Deatherage.

<sup>1</sup>Bear Hybrid Corn Co., Decatur, Illinois.  
Agron. J. 50(10): 595-598. October 1958.

Individual endosperm genes which affect the amylose fraction of corn starch were found to vary in effect due to inherent difference of source stocks. Double and triple recessive combinations of these genes have varying effects on amylose content. The *ae* gene is involved in the higher amylose endosperm combinations although it shows no corresponding effect on the pollen starch.

## DEVELOPMENT OF AMYLOMAIZE--CORN HYBRIDS WITH HIGH-AMYLOSE STARCH. II. RESULTS OF BREEDING EFFORTS.

R. P. Bear,<sup>1</sup> M. L. Vineyard,<sup>1</sup> M. M. MacMasters, and W. L. Deatherage.

<sup>1</sup>Bear Hybrid Corn Co., Decatur, Illinois.  
Agron. J. 50(10): 598-602. October 1958.

Extensive selection on the basis of laboratory analyses is necessary when transferring high-amylose characters from source stocks into agronomically sound amylomaize hybrids. The effects of various gene combinations on the amylose-amylopectin ratio of corn starch are discussed. Amylose content is shown to be influenced considerably by modifying factors interacting within the various endosperm genotypes.

## GLYCERIDE STRUCTURE OF VEGETABLE OILS BY COUNTERCURRENT DISTRIBUTION. III. SAFFLOWER OIL.

C. R. Scholfield and H. J. Dutton.

J. Am. Oil Chemists' Soc. 35(10): 493-496. October 1958.

Safflower oil was fractionated in a 200-tube countercurrent distribution apparatus and was also fractionated after interesterification with C<sup>14</sup>-labelled palmitic acid. The glyceride composition of the interesterified oil was similar to that of the natural oil. The glycerides were separated on the basis of both unsaturation and chain length of the constituent fatty acids and the palmitoglycerides had only slightly higher partition coefficients than the oleoglycerides. The amounts of trilinolein, oleodilinolein, and palmitodilinolein found were similar to those calculated for a random distribution. Distribution of a mixture of safflower oil and olive oil showed that no mixing or randomization of triglycerides occurred during countercurrent distribution. It is concluded that fatty acids in safflower triglycerides are distributed in an essentially random pattern.

## PROGRESS IN RESEARCH ON SOYBEANS.

A. K. Smith.

Soybean Dig. 18(12): 14-17. October 1958.

Recent work is reviewed on the chemical reactions controlling the stability of soybean oil and on preliminary studies tagging fatty acids with tritium for use in soybean oil research. Also given are a preliminary report on the alleged antithiamin factor in soybeans and a summary of a recent survey on the use of United States soybeans in Japan.

## DETERMINATION OF TOCOPHEROL IN OXIDIZED FATS. INTERFERENCE FROM HEAT-FORMED REDUCING SUBSTANCES IN HIGHLY OXIDIZED FATS.

E. N. Frankel, Patricia M. Cooney, C. D. Evans, and J. C. Cowan.

J. Am. Oil Chemists' Soc. 35(11): 600-602. November 1958.

The application of a heating method to remove peroxides for the determination of tocopherol in oxidized fats produced polymeric reducing substances. These heat-produced reducing substances interfere with the tocopherol determination when the peroxide value of the fats exceeds 100.

#### PROMISING MATERIALS FOR PROTECTIVE COATINGS••VINYL ETHERS OF POLYUNSATURATED FATTY ALCOHOLS.

H. M. Teeter, L. E. Gast, and J. C. Cowan.  
Ind. Eng. Chem. 50(11): 1703-1704, November 1958.

Vinyl ethers of unsaturated fatty alcohols derived from linseed and soybean oils polymerize, or copolymerize, with other vinyl ethers to give polymeric products having promise as protective coatings. Films show excellent adhesion to metals, including black iron and aluminum, and they have good resistance to water, alkali, and acid.

#### BEHAVIOR OF THE 11S PROTEIN OF SOYBEANS IN ACID SOLUTIONS. I. EFFECTS OF pH, IONIC STRENGTH, AND TIME ON ULTRACENTRIFUGAL AND OPTICAL ROTATORY PROPERTIES.

W. J. Wolf, J. J. Rackis, A. K. Smith, H. A. Sasame, and G. E. Babcock.  
J. Am. Chem. Soc. 80(21): 5730-5735. November 1958.

Ultracentrifugal and optical rotatory measurements were made to determine the effects of pH, ionic strength, and time on the behavior of the 11S protein of soybeans in acid solutions. Low pH and low ionic strength convert the 11S protein into a slowly sedimenting component apparently as the result of dissociation of the protein into subunits. An intermediate dissociation product is observed under certain conditions. Effects of pH and ionic strength on the 11S protein suggest that dissociation is due to forces of electrostatic repulsion between the subunits. Changes noted with time in some systems were dissociation and aggregation with or without precipitation. Dissociation is accompanied by an increase in levorotation, indicating that configurational changes occur in the subunits. These configurational changes may be responsible for irreversibility of dissociation and for aggregation reactions noted under certain conditions of ionic strength and pH.

#### COMPARATIVE STUDY OF WHEAT FLOUR PHOSPHATIDES.

L. H. Mason and A. E. Johnston.  
Cereal Chem. 35(6): 435-448. November 1958.

Lipids from two hard, red winter wheat flours, Ponca and Red Chief, differing in bread-baking quality were extracted with water-saturated butanol-1 and fractionated with solvents to study compositional differences. Phosphatide fractions from each of the flours were subjected to 800 transfer countercurrent distributions using the solvent system water; methanol; water-saturated butanol; 1-heptane (3:17:40:60). In a large number of the fractions in both distributions, the molar nitrogen-to-phosphorus ratio was very nearly one. Weight curves in general were similar; each showed a major peak comprised of nearly pure digalactosyl glycerides. A major quantitative difference was found in another large peak of both curves which contained a large proportion of choline phosphatides with more material in the distribution from Red Chief, the flour of poor baking quality.

#### CONTINUOUS BATTER PROCESS FOR SEPARATING GLUTEN FROM WHEAT FLOUR.

R. A. Anderson, V. F. Pfeifer, and E. B. Lancaster.  
Cereal Chem. 35(6): 449-457. November 1958.

A continuous pilot plant for carrying out the batter process for the separation of starch and gluten from wheat flour has been designed and constructed. Flours milled from different types of wheat have been successfully processed in this plant. In most cases, the recovery of protein in the gluten has been greater than 80%, with the gluten purity also about 80%. The pilot plant, which is made up of conventional equipment, is quite versatile and amenable to simple scale-up.



#### VITAL WHEAT GLUTEN BY DRUM DRYING, I. EFFECT OF PROCESSING VARIABLES.

V. F. Pfeifer, Charles Vojnovich, and R. A. Anderson.

Cereal Chem. 35(6): 458-468. November 1958,

Dry vital wheat gluten was prepared by atmospheric drum drying of wet gluten dispersed in dilute acid. The wet gluten is dispersed in acid, preferably acetic, at a pH in the range of 4.5 to 5.1 and at a solids content in the range of 10 to 25%. Steam pressure in the drums is relatively unimportant, but complete dispersion of the gluten is essential in order to produce a vital material. Products of good quality were obtained over a wide range of conditions, but for any one type of wet gluten, a set of optimum conditions could be determined that would yield gluten nearly equal to that produced by vacuum drying under the mildest conditions. Approximate cost calculations indicate a plant production cost between 3 and 4 cents per lb. to produce 6,000,000 lbs. of dried gluten per year.

#### STUDIES ON THE PROTEIN IN SOYBEAN HYPOCOTYL.

Joseph J. Rackis, Allan K. Smith, and Henry A. Sesame.

Arch. Biochem. Biophys. 78(1): 180-187. November 1958.

A method has been developed for the separation of soybean hypocotyl. In this study, a comparison of the solubility electrophoretic and ultracentrifugal behavior of the hypocotyl and cotyledon proteins was made.

From the data collected thus far, it is apparent that the proteins have many similar as well as widely different properties. Nearly 80% of the nitrogen in aqueous extracts of both hypocotyl and cotyledon have a minimum solubility near pH 4.2 (acid-precipitated protein), whose isoelectric point shifts to pH 5.1 with the removal of phytic acid. Electrophoretically, both proteins contain one major component with the same mobility and four or five minor components. In the absence of phytate, the major component of the hypocotyl protein dissociates into two electrophoretic fractions.

Ultracentrifugal analysis reveals additional differences between the two protein systems. At pH 7.6, the hypocotyl protein contains three resolvable fractions whose molecular weights are lower than the four fractions found in cotyledon proteins. Enzymatic activity in aqueous extracts of hypocotyl and cotyledon differs widely. Only negligible amounts of hemagglutinating activity was found in the hypocotyl, indicating that the toxic protein is concentrated in the cotyledon.

#### PRESERVATION OF MICROORGANISMS BY FREEZE-DRYING. I. CELL SUPERNATANT, NAYLOR-SMITH SOLUTION, AND SALTS OF VARIOUS ACIDS AS STABILIZERS FOR *SERRATIA MARCESCENS*.

R. G. Benedict, J. Gorman, E. S. Sharpe, C. E. Kemp, H. H. Hall, and R. W. Jackson.  
Appl. Microbiol. 6(6): 401-407. November 1958.

Following the development of fermentation conditions to consistently produce dense viable populations of *Serratia marcescens*, the cells were concentrated, water-washed, and combined with a variety of neutralized chemical stabilizers prior to freeze-drying in a special vacuum unit. Quantitative methods were employed to determine the percent survivals after drying. When known chemicals or combinations thereof were used as stabilizers, the importance of the ratio of stabilizer to cells in subsequent drying survivals was clearly demonstrated. Urea offers promise as a drying stabilizer for bacteria. Marked improvements in the drying survivals of a sensitive yeast and yeastlike organism were obtained after substantial modifications of a standard drying technique were made.

#### SURVIVAL DURING STORAGE OF *SERRATIA MARCESCENS* DRIED BY CONTINUOUS VACUUM SUBLIMATION.

H. G. Maister, V. F. Pfeifer, W. M. Bogart, and E. N. Heger.  
Appl. Microbiol. 6(6): 413-419. November 1958.

The various factors affecting survival during storage of *Serratia marcescens* strain 8 UK after freeze-drying by a continuous vacuum sublimation method were investigated.

Dried pellets and powder were stored in vacuum or atmospheres of inert gases at different temperature levels for a given period of time. The time required for a 50% reduction of original viable cell population varied with conditions of storage; at 50° C. the organisms do not remain alive for more than a few weeks, whereas at 20° C. and below practically no decrease in viability could be observed after 6 months of storage.

#### SELECTIVE HYDROLYSIS OF SOYBEAN OIL PHOSPHATIDES.

R. E. Beal.

J. Am. Oil Chemists' Soc. 35(12): 681-684. December 1958.

In the hydrolysis of phosphatides by aqueous solutions of acids or bases the glycerol-phosphoric acid bond is the most resistant to attack. When hydrolysis is conducted with enzymes, which are more specific in their action, splitting may be affected at any point in the phosphatide molecule by the selection of appropriate lipases. However, phospholipases have disadvantages: they are slow-acting and require a buffered medium. Treating nondegummed soybean oil or gums therefrom with water in the presence of mixed anion and cation exchange resins splits off over 85% of the phosphorus without appreciable increase in free fatty acid content. The hydrolysis is effected by the cation resin while the anion resin inhibits free fatty acid formation. The reaction is rapid at 125° C. without perceptible darkening of the oil. Di- and monoglycerides are formed.

#### REACTIONS OF UNSATURATED FATTY ALCOHOLS. VI. GUERBET REACTION OF SOYBEAN AND LINSEED ALCOHOLS.

L. E. Gast, E. D. Bitner, J. C. Cowan, and H. M. Teeter.

J. Am. Oil Chemists' Soc. 35(12): 703-707. December 1958.

Soybean and linseed alcohols were heated with potassium hydroxide and boric anhydride to produce mixtures of  $\alpha$ -branched alcohols (Guerbet alcohols) with average molecular weights of 720-860. Thermo cross-linking and multiple Guerbet reactions probably account for the high molecular weight. These products contained little or no ethers, esters, or carbonyl compounds.

Acrylic, sorbic, maleic, and soybean esters of soybean and linseed Guerbet alcohols were prepared. Both the Guerbet alcohols and their esters form moderately hard films on baking. These films show good resistance to alkali and solvents.

#### MORPHINE EXTRACTION FROM DOMESTICALLY GROWN OPIUM POPPY.

O. L. Brekke, G. C. Mustakas, J. E. Hubbard, H. G. Maister, L. Van Ermen, M. C. Raether, and C. T. Langford.

J. Agr. Food Chem. 6(12): 927-929. December 1958.

To meet the needs of our nation in an emergency, a process was developed for the recovery of a crude morphine liquor from mature, domestically grown, poppy plants. This paper, the first of two, describes a procedure for preparation of the meal and for extraction of the morphine. Stems and seed were separated from the capsular material with a 6% loss of morphine. The capsular material was ground to pass a 20-mesh sieve and, after treatment with aqueous ammonia and wetting liquor, over 95% of the morphine in the meal was extracted with water-saturated isobutanol in a continuous countercurrent extractor. Liquor pressed from the extracted meal was recycled.

#### MORPHINE RECOVERY FROM A 2-BUTANOL EXTRACT OF OPIUM POPPY MEAL.

O. L. Brekke, H. G. Maister, G. C. Mustakas, L. Van Ermen, M. C. Raether, and C. T. Langford.

Ind. Eng. Chem. 50(12): 1733-1736. December 1958.

Two methods were developed to recover morphine and other alkaloids from an isobutanol extract of poppy meal. The crude morphine liquor from either process contained about 2% morphine and 0.3% codeine and is suitable as a raw material in a morphine refinery normally using imported opium.

In one process, the alkaloids were adsorbed on a cation exchanger and eluted with weak alkali. The eluate was then neutralized and concentrated under vacuum to produce the crude morphine liquor. In the other process, an isobutanol-water azeotrope was fractionally distilled from the extract liquor while the alkaloids and other extraneous and tarry solids were transferred to an aqueous phase. Occluded morphine was extracted from the tarry solids, and then the resultant extracts and the aqueous solution were concentrated under vacuum.

#### SEXUAL AGGLUTINATION OF HETEROTHALLIC YEASTS IN DIVERSE TAXONOMIC AREAS.

Lynferd J. Wickerham.

Science 128(3337): 1504-1505. December 1958.

Sexual agglutination found previously in *Hansenula wingei* has now been found in species of four genera of yeasts. Manifestation of the phenomenon is different in the various species. The result is to intensify greatly sexual reactions and to increase ploidy of the species in which it occurs. This reaction should be of interest to geneticists because it enhances hybridization, and to industrialists because of its potentials. Also, it should prove a useful tool in the study of mechanisms of agglutination.

#### SOYBEAN UTILIZATION RESEARCH.

J. C. Cowan.

The Cotton Gin and Oil Mill Press 59(25): 7, 27-28. December 1958.

Current lines of work on soybeans are reviewed: Vinyl ether polymers, soybean oil stability, labeling fatty acids with tritium, analysis of unsaturated acids in soybean oil by gas chromatography, and use of U. S. soybeans in Japan.

#### A KINETIC STUDY OF DEXTRANSUCRASE.

C. S. Stringer and H. M. Tsuchiya.

J. Am. Chem. Soc. 80(24): 6620-6625. December 1958.

Dextran synthesis by cell-free enzyme preparations derived from *Leuconostoc mesenteroides* NRRL B-512F requires both sucrose and a suitable "acceptor" cosubstrate. Molecules of the latter serve as initiators for the formation of new chains. At sucrose concentrations greater than about 0.01 M, the initial rate of reaction depends upon the availability of the acceptor, as well as upon sucrose concentration. The effect of a model acceptor substrate,  $\alpha$ -methyl glucoside, upon some of the kinetic properties of dextranase is reported. The initial rate of reaction has a first order dependence upon  $\alpha$ -methyl glucoside concentration in the range 0.15-0.8 M; below 0.15 M the measured rate is in part due to an unidentified acceptor substrate. Data indicate that this substance is not a contaminant of the enzyme preparation. First-order dependence of the rate upon sucrose concentration is confirmed in the range 0.01-0.11 M; the dependence changes through zero order to an inverse dependence (inhibition) at higher sucrose concentrations, as Hehre<sup>3</sup> earlier reported, in the absence of  $\alpha$ -methyl glucoside.  $\alpha$ -Methyl glucoside relieves the inhibition. Estimates of the Michaelis constant and maximum velocity for either sucrose or  $\alpha$ -methyl glucoside depend upon the concentration of the other reactant. An equation is derived which describes the dependence of rate upon the concentrations of sucrose and  $\alpha$ -methyl glucoside over the ranges 0.01-0.11 and 0.15-0.80 M, respectively. The data are compared with the behavior predicted by certain reaction mechanisms.



~~xxx~~ ADD TO ARS-71-3, SUPPLEMENT 8

LIST OF PUBLICATIONS AND PATENTS, Oilseeds and Related Subjects.

U. S. Dept. Agr. ARS-71-5, Supplement 3, March 31, 1958. 3 pp.

\* GROUP INTERCHANGE ON THE SUBJECT: HOMOPOLYSACCHARIDES.

Allene R. Jeanes.

Polysaccharides in Biology. Transactions of the Third Conference, May 28-31, 1957, Princeton, N. J., sponsored by the Josiah Macy, Jr. Foundation. pp. 130-147. 1958.

~~xxx~~ ADD TO ARS-71-3, SUPPLEMENT 6

THE ISOLATION, CHARACTERIZATION, AND CHEMICAL PROPERTIES OF THE GIBBERELLINS.

Frank H. Stodola.

Presentation at symposium on Natural Plant Growth Regulators, Other than Auxin, sponsored by the American Society of Plant Physiologists, at the American Institute of Biological Sciences meeting, Storrs, Connecticut, August 28, 1956.

~~xxx~~ ADD TO ARS-71-3, SUPPLEMENT 5

SYMPOSIUM ON BACTERIAL PIGMENTS.

Robert P. Williams, Herman C. Ellinghausen, James A. Green, Roger L. Harned,

William C. Haynes, and Jose A. Rivera.

Bacteriol. Rev. 20(4): 282-284. December 1956.

SYMPOSIUM ON PROBLEMS IN TAXONOMY.

Carl S. Pederson, R. E. Buchanan, Margaret Pittman, Sidney Leopold, Charles D. Dukes, Reese H. Vaughn, Eric R. Brown, E. Lee Treece, Kenneth L. Burdon, C. W. Hesseltine, and N. M. McClung.

Bacteriol. Rev. 20(4): 274-277. December 1956.

CONTRACT RESEARCH PUBLICATIONS

(Report of research work done by an outside agency under contract with the U. S. Department of Agriculture and supervised by the Northern Utilization Research Branch of the Agricultural Research Service.)

BIOCHEMISTRY OF THE SPHINGOLIPIDES. X. PHYTOGLYCOLIPIDE, A COMPLEX PHYTOSPHINGOSINE-CONTAINING LIPIDE FROM PLANT SEEDS.

H. E. Carter, W. D. Celmer, D. S. Galanos, R. H. Gigg, W. E. M. Lands, J. H. Law, Katherine L. Mueller, T. Nakayama, I. H. Tomizawa, and Evelyn Weber.

J. Am. Oil Chemists' Soc. 35(7): 335-343. July 1958.

CHEMICAL COMPOSITION AND END GROUPS OF THE SOYBEAN HEMAGGLUTININ.

Shohachi Wada, M. J. Pallansch, and Irvin E. Liener.

J. Biol. Chem. 233(2): 395-400. August 1958.

INACTIVATION STUDIES ON THE SOYBEAN HEMAGGLUTININ.

Irvin E. Liener.

J. Biol. Chem. 233(2): 401-405. August 1958.

\*COPOLYMERIZATION OF TRIALKYL ACONITATES WITH VINYLIDENE CHLORIDE.

C. S. Marvel and Eloisa B. Mano.

J. Polymer Sci. 31(122): 165-171. August 1958.

~~xxx~~ Notice of publication omitted from this issue.

WETTING OF POLYMER SURFACES. I. CONTACT ANGLES OF LIQUIDS ON STARCH, AMYLOSE, AMYLOPECTIN, CELLULOSE AND POLYVINYL ALCOHOL.

B. Roger Ray, J. R. Anderson, and J. J. Scholz, University of Illinois, Urbana, Illinois.  
J. Phys. Chem. 62(10): 1220-1227. October 1958.

WETTING OF POLYMER SURFACES. II. CONTACT ANGLES OF LIQUIDS ON ESTERS AND ETHERS OF AMYLOSE AND AMYLOPECTIN.

J. J. Scholz, B. Roger Ray, and J. R. Anderson. University of Illinois, Urbana, Illinois.  
J. Phys. Chem. 62(10): 1227-1230. October 1958.

BIOCHEMISTRY OF THE SPHINGOLIPIDES. XI. STRUCTURE OF PHYTOGLYCOLIPIDE.

Herbert E. Carter, R. H. Gigg, John H. Law, Teishi Nakayama, and Evelyn Weber.  
J. Biol. Chem. 233(6): 1309-1314. December 1958.

POLYMERS AND COPOLYMERS OF HYDRONOPYL ACRYLATE.

C. S. Marvel, Roland Schwen, R. W. Hobson, and R. J. Coleman.  
J. Polymer Sci. 38(126): 27-37. December 1958.



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PATENTS

These patents are assigned to the Secretary of Agriculture. Copies of patents may be purchased from the U. S. Patent Office, Washington, D. C.

PRODUCTION OF A VITAMIN CONTAINING NUTRITIONAL COMPOSITION CONTAINING ANTIBIOTICS.

Harlow H. Hall and Robert G. Benedict.  
U. S. Patent 2,846,310, August 5, 1958.

A particular strain of *Streptomyces* is cultivated in a cobalt-containing medium to produce a fermentation product containing vitamin B<sub>12</sub> and a complex of antibiotics. The product, when mixed with a feed formula confers superior weight gaining properties to the formula.

S-(1,2-DICHLOROVINYL)-GLUTATHIONE AND METHOD FOR ITS PREPARATION.

Arthur C. Eldridge and Leonard L. McKinney.  
U. S. Patent 2,849,434, August 26, 1958.

The trisodium salt of glutathione was prepared by adding glutathione to liquid ammonia containing the required amount of sodium. Trichloroethylene was then added to the liquid ammonia solution to produce disodium S-(1,2-dichlorovinyl)-glutathionate. After removing the ammonia, the residue was dissolved in water and the pH adjusted to 3 to precipitate S-(1,2-dichlorovinyl)-glutathione. The compound exhibits great fungicidal and algacidal action.

PROCESS FOR INHIBITING STALING OF YEAST RAISED BAKERY PRODUCTS.

Chester W. Ofelt, Charles L. Mehlretter, and Felix H. Otey.  
U. S. Patent 2,850,389, September 2, 1958.

Procedure for inhibiting the staling of yeast-raised bakery products which comprises incorporating into the dough, prior to baking, about 0.1 to 1.0%, based on the weight of the flour, of a monoester of a long-chain fatty acid containing from 18 to 22 carbon atoms and D-glucose in which the hydroxyl group on carbon atom 3 of D-glucose is esterified. The compound 3-stearoyl-D-glucose is mentioned specifically.

ESTERS OF  $\gamma$ -(TETRAHYDRO-2-FURYL) ALKANOLS.

Charles R. Russell, Lester E. Schniepp, Louis S. Lafner, and Herbert E. Smith.  
U. S. Patent 2,864,823, December 16, 1958.

New compounds, esters of  $\gamma$ -(tetrahydro-2-furyl) alkanols, are useful as extreme temperature lubricants. Examples are 4-(tetrahydro-2-furyl)-2-butyl 2 ethylcaproate and pelargonate, and di-[4-(tetrahydro-2-furyl)-2-butyl] adipate, azelate and subacate.

METHOD OF MAKING CAROTENES AND RELATED SUBSTANCES BY MIXED CULTURE FERMENTATION.

Clifford W. Jesseltine and Ralph F. Anderson.  
U. S. Patent 2,865,814, December 23, 1958.

This invention concerns the use of opposite mating types of *Mucorales* together in aerobic fermentations to produce carotenoids and related substances. It also involves the use of *Mucorales* of opposite mating types with each mating type belonging to a different species or genus for the production of carotenoids and related substances. Carotenoids are also produced by unmated *Mucorales* but to a lesser extent.

PRODUCTION OF AN ANTIBIOTIC MIXTURE HAVING ANTIBACTERIAL AND ANTIFUNGAL ACTIVITY.

Lloyd A. Lindenfelser, Robert G. Benedict, Odette L. Shotwell, Thomas G. Pridham,  
Frank H. Stodola, and Richard W. Jackson.  
U. S. Patent 2,865,815. December 23, 1958.

A process for producing an antibiotic mixture which comprises cultivating *Streptomyces cinnamomeus* forma *azacoluta* in an aqueous medium containing an assimilable carbon source and an assimilable nitrogen source, under aerobic conditions at a temperature from about 24 to 36° C., for a period from about 1 day to about 7 days, until substantial antibacterial and antifungal activity is imparted to the medium.

The above process wherein the solids are separated from the culture medium and the bulk of water is evaporated from the medium produces a solid product having antibacterial and antifungal activity.